



The Significance of Using Ict in Telemetric Monitoring, Process Weighing and Control of The Coal

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Abstract

The aim of this article is to present the indicators that affect the technical feasibility and economic justification of investment in ICT infrastructure and information systems. We performed this task by reviewing the specific case study "Construction of computer networks and information systems for weighing and control of coal in RMU Banovići". The article presents the technical aspects of implementation and operation of such projects and the potential savings as well as the ability for a better control of the revenue side of the company, which brings better results for business and competitiveness in the market economy.

INTRODUCTION

"The implementation and exploitation of computer networks and information systems can produce significant savings and business control."

By analyzing the case study "Construction of computer networks and information systems for weighing and control of coal in RMU Banovići" we will achieve the aims mentioned above and presents elements that should confirm the aforementioned hypothesis [4]. The ICT project was intended to realize the following activities:

- Implement the scales aimed to correct the two scales that are used for weighing coal for mass consumption;
- Implement the necessary systems of controlling scales, processing, collection and forwarding current information (video surveillance of the scales, the installation of computers, applications, printers and backup power at the location of all six scales);
- Create a computer network at the location of separation, where it was necessary to connect the ICT equipment and the scales located where the scales with central distribution of the computer network are at the location of the Board Separation;

- Create a communication channel with the server hall in the headquarters and a telemetry monitoring of the weighing system on the computers of persons responsible for the control;
- Create and implement a system for automatic controlling of the weighing process (sensor system, automatic ramp, PLC, display);
- Define and create a security policy approach (firewall);
- Backup systems and alternative power supply (UPS);
- Implement a server for collecting and processing data at a joint location, installing elements of an information system on all computers [3];
- Conduct training for the use and maintenance of the implemented project.

RMU Banovici is engaged with the coal production and has different types of coal to be sold to a range of consumers and power plants.

Annual production is at the level of 1.5 million tons of separated coal with an average price of 100 KM. The management evaluates that the additional control measures in the weighing system can bring significant cost savings, take care for the quality of delivery and customer satisfaction and improve business.

To achieve this goal they gave the task of investigating the possibility and a potential necessity of implementing ICT technology.

INFORMATION AND COMMUNICATION INFRASTRUCTURE

Information and communication infrastructure consists of a network (LAN) at the location of OJ Separation, O.J. Directorate and the communication link (optics) at the location of Directorate - Separation. Directorate and Separation are connected with fiber optic cable system. Fiber optic cable system ends on ODF (Optical Distribution Frame), whereas the connection with Ethernet is done via FO media converters, Layer 2 and Layer 3 switches.

Distribution cabinets are connected to the LV network and grounded. The connection of the scales with the distribution boxes in O.J. Separation was done with a single-mode optical fiber going to each of the scales, and distribution is realized through the media converter, layer 2 switch, and all the components on the locations of the scales.

Therefore SFTP Cat 6 cables connected the computer, video surveillance, scales, printer, and in the case of trucks scales it also connected the module for the automatic control of the weighing process (PLC, sensor system, automatic barrier and display).

In O.J. The separation implemented computer network cabling from the distribution cabinet to the offices for operational affairs and supervision of the weighing process.

Via the distribution cabinet and the optics all this is connected with the Directorate, i.e. the hall with a central server, backup server, cabled computer local area network and thus creating the ability of installing user applications on individual computers that are responsible for entering and tracking of commercial parts of the weighing system (Sales Department).

The image of the optic cable distribution and Layer 3 Switch on the location of the Directorate is shown below.

At the locations of the scales it was necessary to implement the interface converter, with different characteristics that are dependent on the scale. The RS232 / 485 interface or RS232 / 485 – Ethernet were used for this purpose. In all distribution cabinets, where we have ICT equipment there are appropriate UPS constant power supplies. Server is located at the locations of the Separation and the Directorate.

INFORMATION SYSTEM FOR WEIGHING

Construction of a single information system for weighing apart from well-structured infrastructure also requires proper implementation of the network layer. It was necessary to connect 6 scales with different types of production in different locations, and then collect the information they provide and integrate them into the same common base of information system. Block diagram of an information system for the weighing is shown in Figure 1.

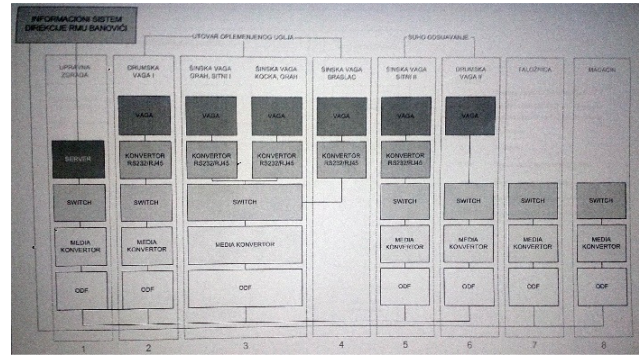


Figure 1. Diagram of an information system for the weighing

The aim was to fully automate weighing system, which required the implementation of some parts of the automatic control system like:

- Automatic barrier to enter and exit the scale (which would be lifted only when the measurement is completed, and data would be in the database);
- Video surveillance (which would record the scales, i.e. all the activities in the process of weighing);
- The sensor system (controlling the vehicle position on the scales);
- PLC system (control of loading of coal and ramps, connected with sensor system and application);
- Application connection with the business program in RMU Banovići responsible for automatic download of data, processing, creation of delivery reports and other documents relevant to the process of weighing.

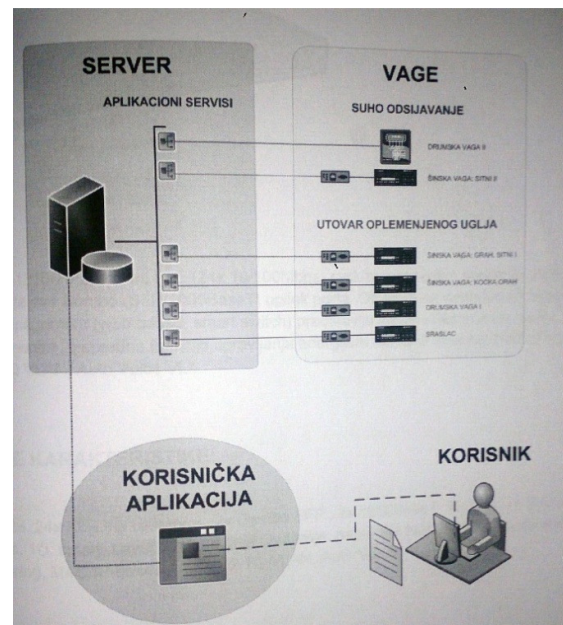


Figure 2. Application Structure of the Information System for Weighing

Application structure of the information system consists of databases, applications for data collection, and applications for processing the data.

The entire system is designed modularly, and in the case of adding compatible scales major reconstructions of this information system are not required [5]. The database was created in Microsoft SQL Server Express, which is free, and the information system is designed on the Microsoft platform. Applications are programmed to have multiple levels of access.

The levels of access are: administrators, users, inspection, maintenance). Data from the base are protected through the access levels (within the system), firewall (outside), backup data from the database on another location (the computer) and periodical archiving of the backup media. In the process of collecting data from the scales, it was necessary to adapt applications to the two types of protocols, with two types of scales which are assembled (truck and rail).

TELEMETRIC MONITORING, MANAGEMENT AND CONTROL OF THE WEIGHING PROCESS

The system of telemetry monitoring, management and control is designed through the implementation of control scales for truck scales, sensor system, ramp and PLC. Furthermore, at all locations of weighing a video surveillance system that monitors the weighing process was installed. Control scales are made up of two modules that are connected to the existing weighing system and serve primarily to control current weighing, as an additional tool for the analysis of potential deviations, and to provide feedback in case of conflict with the basic scales.

The control scales system is not affected by the weather (rain, ice), or slipping due to contamination, etc...

Control scales are connected to the computer network and in that way they can be accessed remotely, and have the option of saving weighing within its memory and on the remote computer, and the data collected can be used for later analysis.

The video surveillance system is implemented on each of the scales, and with a computer network, server, optical connectivity with the management [2], serves for monitoring the weighing process, as well as for securing people and property which is a responsibility of a special service, so the user application for monitoring video surveillance is installed at the service location in the Directorate and separation.

An automatic control system was created at the location of truck scales. Sensor systems ensure that there is no weighing while the truck is not properly positioned on the scales.

Automatic barrier serves to secure a weighing process, that there is no movement of the truck until the entire weighing process is not completed and there is no arrival of a new truck as long as the existing one did not receive its shipping label, and the process of weighing is not completed.

PLCs are used to connect computers, applications, databases, printers, scales, sensor system, a barrier and through them the entire scales management system program is automated.

The truck system transport is regulated by giving numbers, and the information about the numbers is seen on the display located in a prominent place above the scales.

RESULTS

The video surveillance system provides an ability for a better control of people and property, consistent weighing procedures, a better efficiency and effectiveness.

The usage of the information system for weighing provides the ability for automatic recording of the weighing, automatic creation of delivery notes and invoices, creating the control documents without being negatively affected by people, the possibility of a remote control, archiving and delivering the exact amount of coal as defined by the initiated procedure.

Installing and using the control scales gives an additional option for a logical control scales that are exposed to higher risks of manipulation and produces an additional psychological aspect for all participants of the coal weighing process.

Computer network and communications infrastructure, as well as other computer equipment allowed the mutual interaction of the scales, with a higher number of users, from the customer (through the payment receipts, waybill and invoice), workers on the scales, to the participants in the internal control, analysis and reports.

The implementation of control systems consisting of a sensor system [1], automatic barriers, display and PLC, provides a better control, minimizing the impact of people in the process of weighing, increasing the certainty of a regular weighing process, protecting the customers' interests, increasing customer confidence, reducing the possibility of justified complaints, the risks of stealing, mistakes ...

Through the realization and implementation, and later exploitation of ICT equipment and information system through the above segments in the first year we achieved economic savings of 240,000.00 KM, and the price of the investment is approx. KM 200,000.00.

By comparing the total value of the investment, with the indicator of economic savings we found that the investment payback period is 10 months.

CONCLUSIONS

Increasing the efficiency and effectiveness of working staff, better safeguarding of the assets, fairer and more equitable relationship with the customer, the possibility of additional analyzes and controls are advantages of using information and communication technologies in the specific case study which in all aspects (technical and economic and social) have a positive impact on the competitiveness of the company and future business.

We finally concluded that there is no alternative to the application of ICT infrastructure and information systems because of the conditions of market economy, rapid change, the need for greater control of the revenue and expenditure sides, the communication speed and other positive effects.

The hypothesis was thus confirmed, and the goals were reached. This article contributes to the establishment of a better way of looking at the benefits of using ICT in the business of modern companies and its results may hopefully animate the subjects to bring the use of ICT technology to a larger extent.

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